Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 January and 31 March 2005

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Background

The U.S. Atlantic Pelagic Longline fleet operates throughout the Northwestern Atlantic Ocean including along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the central North Atlantic ocean. The longline fishery has a documented history of incidental takes of non-target species including billfish, marine turtles, and marine mammals. During recent years there have been elevated takes of leatherback turtles in the Gulf of Mexico (Garrison, 2003; Garrison and Richards, 2004). As a result, a Biological Opinion on the pelagic longline fishery was recently developed by NOAA Fisheries under the Endangered Species Act requiring several actions to be taken to improve monitoring and reduce interactions with leatherback and loggerhead turtles. These regulations reopened the NED, with restrictions, on June 30, 2004 and similar restrictions were imposed upon the rest of the fleet effective August 5, 2004. These regulations mandate that all longline gear use 16/0 or 18/0 circle hooks and eliminates J-hooks from the fishery. This quarterly report includes fishing under the new regulatory regime.

The biological opinion requires quarterly reporting of interactions with protected species including marine mammals and marine turtles. The goal of this measure is to more closely monitor any potential short-term increases in interaction rates and thereby allow a more responsive management program. This report meets this requirements and includes the observed fishery effort and incidental takes observed by the pelagic longline observer program (POP) including sets from January 1, 2005 to March 31, 2005.

While it would be desirable to estimate the absolute level of takes (i.e., total number of turtles taken), this is not currently possible because the fishery effort data is reported on logbook forms by fishing captains. These data are not available until several months after the end of any given quarter. Therefore, I present the bycatch rate (i.e., catch per unit effort) based solely on observer data as an indicator of the relative level of interactions with protected species. The observed bycatch rate by fishing area during 2005 is compared to that observed in 2004 and the average of the previous five years (2000-2004) to assess whether or not the observed rate in 2005 is unusually high or low. Bycatch rates are calculated applying the delta log-normal method using hooks as the unit of effort, and the analytical methods are described in detail in Garrison (2003).

Results and Discussion

A total of 178 longline sets (~132,000 hooks) were observed during quarter 1 of 2005 (Table 1). The Gulf of Mexico had by far the highest number of observed sets.

There were 9 observed interactions with leatherback turtles and 7 interactions with loggerhead turtles during this quarter (Table 2). All turtles were listed as released alive and injured by the observer (Appendix A). The majority of interactions with both species were observed in the GOM area (Table 2). The locations of observed sets and turtle interactions are shown in Figure 1.

There were 2 marine mammal interactions observed including a bottlenose dolphin and a Risso's dolphin (Table 3). Both marine mammals were released uninjured based upon observer comments and serious injury criteria (see Garrison, 2003). Interactions with marine mammals were observed only in the SAB and GOM regions (Figure 3).

The quarterly and regional bycatch rates are summarized for turtles in Table 4 and for marine mammals in Table 5. These rates are compared with those from the same quarter/area for 2004 and the average from 2000-2004 in Tables 6-7. Specific information on injuries to sea turtles and gear characteristics of each interaction are shown in Appendix A.

For leatherback turtles, the catch rate observed in the Gulf of Mexico was lower than those observed during previous years in quarter 1. However, the 95% confidence intervals for 2005 overlap with those from 2004 and the combined estimate of 2000-2004, and therefore the estimate from the current year is not significantly different from that in previous years. The bycatch rate in the FEC region was slightly higher than, but consistent with those observed in previous years. The lack of observed interactions in the SAB area was unusual compared to previous years where the observed interaction rate in previous years was high. The lack of coverage in the SAR area during this quarter may be important as takes had been observed in that area during the previous five years (Table 6a).

For loggerhead turtles, the bycatch rates in the CAR and SAB were consistent with those observed in previous years (Table 6b). The bycatch rate in the MAB was lower than the average observed during the 2000-2004 period (Table 6b). The interactions observed in the GOM were unusual for this quarter as only one take had been observed in the previous five years; however, the observed bycatch rate for 2005 was within the 95% confidence limits of the previous years (Table 6b). This is also the first time loggerhead turtles have been observed taken on a circle hook in the Gulf of Mexico.

Neither bottlenose dolphins nor Risso's dolphin had been observed taken in the pelagic longline fishery during the previous five years. Bottlenose dolphins are taken only rarely in the Atlantic pelagic longline fishery, while Risso's dolphins have occasionally been taken in the GOM in the historical data.

Only circle hooks (16/0 and 18/0) were observed during this quarter, consistent with recent regulations for this fishery. Concerted efforts by fishermen to remove hooks and disentangle

captured turtles are also mandated by the Biological Opinion. All 9 leatherback turtles captured during this quarter were hooked, most typically in the armpit or on the shoulder. In 5 of these 9 leatherback turtles, the hook was successfully removed and only 1 leatherback was released with entangling gear (1 ft. long, Appendix A). All 7 loggerhead turtles were also hooked and either swallowed the hook (n = 3) or were hooked in the mouth (n = 4). In 3 of these turtles, the hook was successfully removed (Appendix A). There was a minimal amount of line (< 1 ft.) left on those hooks not removed.

There are a number of caveats and uncertainties associated with the current analysis. First, while these data have gone through an initial audit and review, they are subject to change upon further review after the end of the 2005 calendar year. Second, the delta log-normal estimator was applied to calculate bycatch consistent with previous estimates (e.g., Garrison 2003). This approach assumes 1) that catch rates (animals per hook) are lognormally distributed and 2) that the number of hooks is an appropriate unit of effort. The first assumption has been evaluated for turtles; however, violations of this assumption may result in biased (positive or negative) estimates of catch rate and associated variances. The second assumption has not been examined critically in previous analyses. If this assumption is not correct, for example if there are saturation effects resulting in a non-linear relationship between the number of hooks and total catch, then there is potentially a bias in the estimate of bycatch rate and total bycatch.

The interaction between longline gear and marine turtles is a relatively rare event and is therefore inherently variable. Historically, there have been very large interannual fluctuations in bycatch rates and therefore estimates of total bycatch. Thus, any differences observed between short term observations of bycatch rates and long term averages may be simply stochastic events and are not necessarily indicative of a significant change in the interactions between the longline fishery and protected species.

Literature Cited

Angliss, R.P. and D.P. DeMaster. 1998. Differentiating serious and non-serious injury of marine mammals taken incidental to commercial fishing operations. NOAA Technical Memorandum NMFS-OPR-13: 48 p.

Garrison, L.P. 2003. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2001-2002. NOAA Technical Memorandum NOAA FISHERIES-SEFSC-515: 52 p.

Garrison, L.P. 2004. Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery During January – June, 2004. SEFSC Document #PRD-03/04-10: 19 p.

Garrison, L. P. and P. M. Richards. 2004. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2003. NOAA Technical Memorandum NMFS-SEFSC-527: 57 p.

Table 1. Number of sets and hooks (x1000) observed in the U.S. Atlantic Pelagic Longline Fishery between 1 January – 31 March, 2005 by fishing area.

Area	Sets	Hooks (x 1000)
CAR	10	8.11
FEC	16	9.03
GOM	113	90.35
MAB	21	12.29
NCA	5	4.08
NEC	0	0
NED	0	0
SAB	13	8.62
SAR	0	0
TUN	0	0
TUS	0	0
Total	**178**	**132.48**

Table 2. Total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets beginning between 1 January – 31 March, 2005 by fishing area. All turtles were recorded as being released alive. Areas with missing values indicate no observer coverage during this time period.

Area	Leatherback	Loggerhead
CAR	0	2
FEC	3	0
GOM	6	2
MAB	0	1
NCA	0	0
NEC	-	-
NED	-	-
SAB	0	2
SAR	-	-
TUN	-	-
TUS	-	-
Total	**9**	**7**

Table 3. Interactions with marine mammals observed during 1 January – 31 March 2005 in the U.S. Atlantic Pelagic Longline Fishery. Observer comments and criteria described in Angliss and DeMaster (1998) were used to evaluated serious injury.

Species	Region	Quarter	# Released Un-injured	# Dead	# Serious Injury
Bottlenose Dolphin	SAB	1	1	0	0
Risso's Dolphin	GOM	1	1	0	0

Table 4. Estimated bycatch rate (Catch per 1000 hooks) for (A) Leatherback and (B) Loggerhead turtles by geographic area and during 1 January – 31 March, 2005 in the U.S. Atlantic Pelagic longline fishery. Missing values indicate areas with no observer coverage. CV indicates the coefficient of variation of the estimated rate. All turtles were recorded as released alive.

A. Leatherback Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	10	0	0	-	-
FEC	16	2	0.3262	0.0591	0.7455
GOM	113	5	0.0672	0.0009	0.4533
MAB	21	0	0	-	-
NCA	5	0	0	-	-
NEC	0	-	-	-	-
NED	0	-	-	-	-
SAB	13	0	0	-	-
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

B. Loggerhead Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	10	2	0.2525	0.0283	0.6667
FEC	16	0	0	-	-
GOM	113	2	0.0190	0.0002	0.7039
MAB	21	1	0.0496	0.0025	1.000
NCA	5	0	0	-	-
NEC	0	-	-	-	-
NED	0	-	-	-	-
SAB	13	1	0.3017	0.0910	1.000
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

Table 5. Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area and quarter during 1 January – 31 March, 2005 in the U.S. Atlantic Pelagic longline fishery. CV indicates the coefficient of variation of the estimated rate.

Species	Serious Injury ?	Area	# Positive Sets	# Observed Sets	Mean CPUE	Var CPUE	CV
Bottlenose Dolphin	N	SAB	1	13	0.0833	0.0069	1.00
Risso's Dolphin	N	GOM	1	113	0.0126	0.0002	1.00

Table 6. Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic longline fishery during 1 January – 31 March, 2005 and comparison to 2004 and the average rate from 2000-2004. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates.

A. Leatherback turtles

Area	2005 CPUE	2005 95% CI	2004 CPUE	2004 95% CI	2000-2004 CPUE	2000-2004 95% CI
CAR	0	-	0.0566	0.0116 - 0.2767	0.0758	0.0277 – 0.2077
FEC	0.3262	0.0919 – 1.1583	0.2439	0.1114 - 0.5340	0.2284	0.1406 – 0.3709
GOM	0.0672	0.0295 – 0.1531	0.1213	0.0539 - 0.2732	0.1010	0.0730 – 0.1656
MAB	0	-	0	-	0.0405	0.0083 – 0.1979
NCA	0	-	0	-	0	-
NEC	-	-	-	-	-	-
NED	-	-	-	-	-	-
SAB	0	-	1.2438	0.2544 - 6.08	0.7475	0.3882 – 1.4394
SAR	-	-	0.1933	0.0945 - 0.3955	0.1262	0.0605 – 0.2636
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

B. Loggerhead Turtles

Area	2005 CPUE	2005 95% CI	2004 CPUE	2004 95% CI	2000-2004 CPUE	2000 - 2004 95% CI
CAR	0.2525	0.0795 – 0.8022	0.2600	0.1231 - 0.549	0.2435	0.1380 – 0.4297
FEC	0	-	0.5480	0.2789 - 1.0768	0.3084	0.1992 – 0.4774
GOM	0.0190	0.0057 – 0.0638	0	-	0.0042	0.0009 – 0.0207
MAB	0.0496	0.0101 – 0.2425	0	-	0.1642	0.0693 – 0.3889
NCA	0	-	0	-	0.1612	0.0541 – 0.4804
NEC	-	-	-	-	-	-
NED	-	-	-	-	-	-
SAB	0.3017	0.0617 – 1.4746	1.2438	0.2544 - 6.0800	0.1014	0.0308 – 0.3340
SAR	-	-	0.4273	0.2206 - 0.8279	0.5604	0.3546 – 0.8858
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

Table 7. Summary of bycatch rates for marine mammals in the U.S. Atlantic longline fishery during 1 July – 30 September, 2004 and comparison to rates from the previous year (2003) and the average of the previous five years (1999-2003). 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates. CPUEs reflect total marine mammals caught including alive, dead, and seriously injured animals.

Species	Area	2005 CPUE	2005 95% CI	2004 CPUE	2004 95% CI	2000 - 2004 CPUE	2000-2004 95% CI
Beaked Whale	CAR	0	-	0	-	0.0423	0.0087 – 0.2069
Beaked Whale	SAR	0	-	0	-	0.0212	0.0043 – 0.1039
Bottlenose Dolphin	SAB	0.0833	0.0170 – 0.407	0	-	0	-
Unid. Dolphin	GOM	0	-	0	-	0.0058	0.0012 – 0.0286
Pilot Whale	CAR	0	-	0.0923	0.0281 – 0.3034	0.0472	0.0142 – 0.1569
Pilot Whale	MAB	0	-	0.0974	0.0199 – 0.4759	0.0452	0.0092 – 0.2210
Risso's Dolphin	GOM	0.0126	0.0026 – 0.0618	0	-	0	-

Figure 1. Observed Pelagic Longline effort (light gray) and turtle (symbols) interactions during 1 January – 31 March, 2005. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

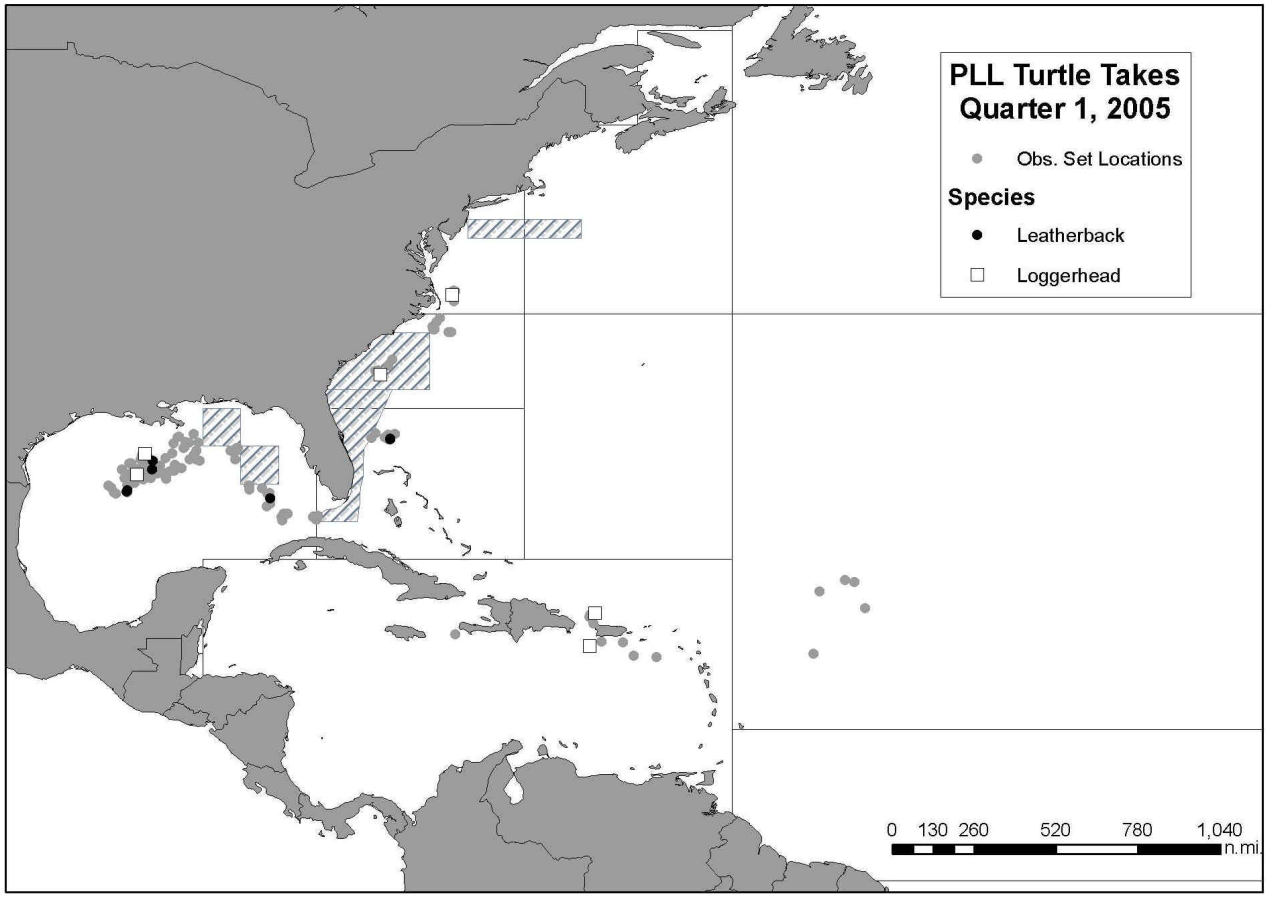
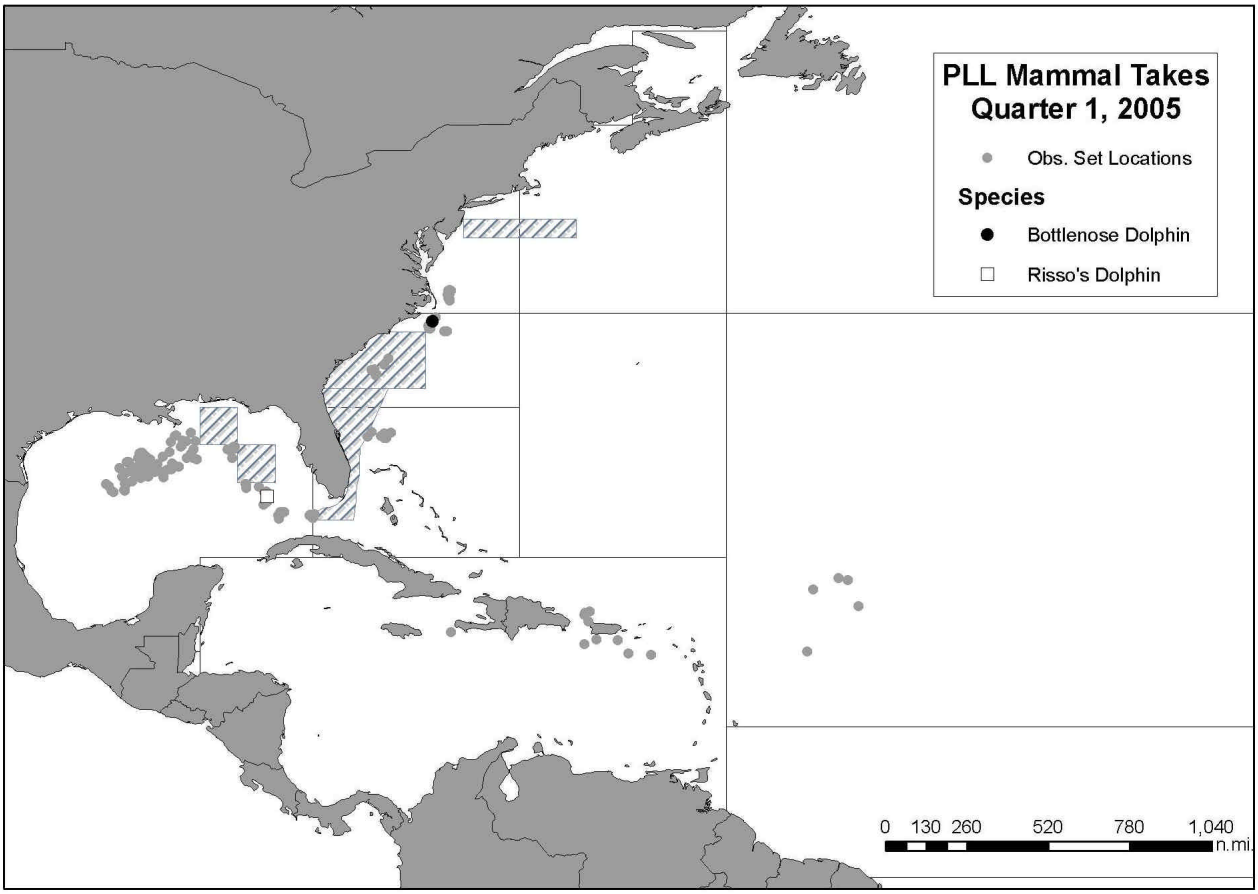


Figure 2. Observed Pelagic Longline effort and marine mammal interactions during 1 January – 31 March, 2005. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.



Appendix A: Injury details and hook type for turtles captured in the pelagic longline fishery for sets beginning during 1 January – 31 March, 2005.

A. Leatherback Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	FEC	C-18/0	10	squid	188	Alive, injured	beak internal	side other	unknown	no	no	no	0.00	6.00		
2	FEC	C-18/0	10	squid	188	Alive, injured	armpit	na	na	no	no	no	0.00	7.00		
3	FEC	C-18/0	10	squid	188	Alive, injured	armpit	na	na	no	no	no	0.00	6.00		
4	GOM	C-18/0	10	mackerel	338	Alive, injured	shoulder	na	na	yes	no	no	0.00	4.00		
5	GOM	C- 16/0	0	squid	171	Alive, injured	beak internal	lower other	na	yes	no	no	0.00	4.00		
6	GOM	C- 16/0	0	squid	171	Alive, injured	armpit	na	na	yes	no	no	0.00	3.00		
7	GOM	C- 16/0	0	squid	125	Alive, injured	armpit	na	na	no	no	no	1.00	4.00		
8	GOM	C- 16/0	0	squid	113	Alive, injured	armpit	na	na	yes	no	no	0.00	4.00		
9	GOM	C-16/0	0	squid	185	Alive, injured	shoulder	na	na	yes	no	no	0.00	4.50		

B. Loggerhead Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	GOM	C- 16/0	0	squid	171	Alive, injured	swallowed	na	partial hook	no	no	no	0.60		73	65.4
2	CAR	C-18/0	10	squid	237	Alive, injured	swallowed	na	not visible	no	no	no	0.50		77.5	70.2
3	CAR	C-18/0	10	squid	237	Alive, injured	swallowed	na	visible to insertion	yes	no	no	0.00		56.8	51.1
4	SAB	C-18/0	10	sq or mack	371 or 167	Alive, injured	glottis	lower	visible to insertion	yes	no	no	0.00		68.4	59.3
5	SAB	C-18/0	10	sq or mack	371 or 170	Alive, injured	swallowed	na	not visible	no	no	no	0.10		70	63
6	MAB	C-18/0	10	sq or mack	375	Alive, injured	mouth	side other	na	yes	no	no	0.00		63	59.5
7	GOM	C-16/0	0	squid	221	Alive, injured	beak	lower other	na	yes	no	no	0.00		79.4	73.2